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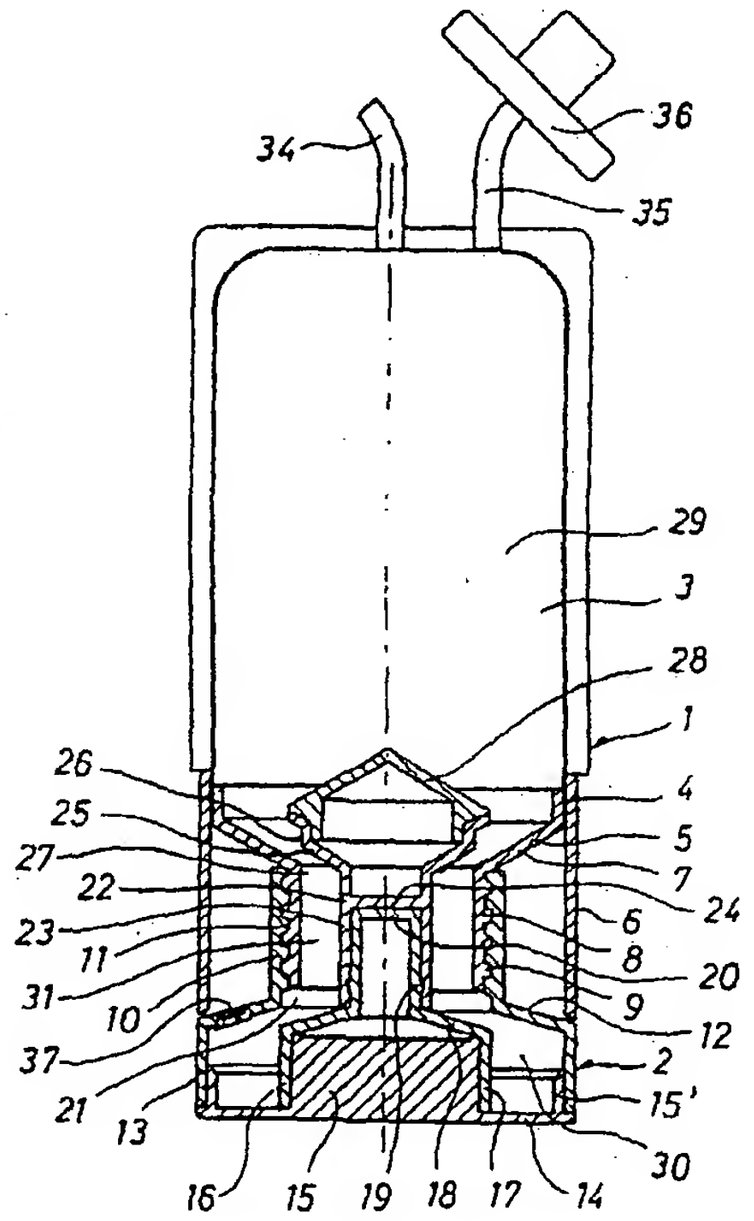
(54) Title: A CONTAINER FOR RECEIVING AND SEPARATING A FLUID, PREFERABLY BLOOD PLASMA, INTO ITS INGREDIENTS

(57) Abstract

A container for receiving and separating blood plasma into its ingredients comprises two sealingly coupled sections (1 and 2). One container section (2) and the adjacent portion of the other container section are made of solid material, and the two container sections are screwed together. The container sections (1 and 2) comprise their respective chambers (29 and 30) for receiving their respective fluid ingredients, and these chambers are interconnected through a connecting channel (31) through the abutting portions, at which the container sections (1 and 2) are screwed together. A valve seat (21, 27) is shaped at each end of the connecting channel (31) for each valve member (22, 16) for a sealing closing of the chambers (29, 30) in the separated state of the container sections (1, 2). The valve members (22, 16) comprise mutually abutting projections (23, 12) ensuring a distance between the valve members (22, 16) exceeding the distance between the associated valve seats (27, 21) in the coupled state of the container sections (1, 2), but being smaller than the distance between the associated valve seats (27, 21) in a position during a separating movement of the container sections (1, 2). Furthermore, retaining means (15, 16) are provided for ensuring that the valve members (22, 19) do not engage the valve seats (27, 21) in the coupled state of the container sections (1, 2).



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Title: A container for receiving and separating a fluid, preferably blood plasma, into its ingredients.

Technical Field

The invention relates to a container for receiving and separating a fluid, preferably blood plasma, into its ingredients, where said container comprises two sealingly coupled sections.

Background Art

It is known inter alia from US-PS No. 4,714,457 to utilize the plasma fraction in blood for the preparation of so-called tissue glue. According to the publication the coagulation factors, such as fibrinogen, fibronectine, factor VIII, and factor XIII are precipitated from the plasma fraction. These coagulation factors are precipitated for instance by cryoprecipitation or by means of a precipitation-promoting agent such as ethanol. The precipitated precipitate includes mainly fibrinogen and is used as tissue glue, such as in connection with operation wounds, by the addition of a suitable enzyme, such as thrombine. Like in nature, the fibrinogen and thrombine form together fibrin, which is an insoluble network of fibre-like material constituting a kind of tissue glue interconnecting the wound surfaces during a healing process. On account of the latter effect, a concentrate of coagulation factors containing mainly fibrinogen turned out to possess a favourable effect on the healing process after an operation. For short, the concentrate of coagulation factors is below referred to as fibrinogen, as said fibrinogen is the main ingredient thereof.

Several methods are today used for separating plasma from blood. The separating process can be performed by means of filters or centrifuging techniques or by way of combinations thereof. The methods are usually known as

"plasmapheresis". The methods have been developed because it is often sufficient to give the patients a plasma transfusion, whereby it is unnecessary also to remove slowly regenerating blood cells from the donor.

The precipitation of fibrinogen from plasma has previously been performed in closed bag systems. The precipitation into such bags (blood bags) necessitated production of particular means for securing the bags in a for centrifugal bowl, in which the centrifuging is to be performed. In addition, it is difficult to separate the fibrinogen from the plasma in a reliable manner. The flexibility of the blood bags often results in the viscous fibrinogen loosening from the bag and mixing with a remaining plasma in the bag, whereby the concentration is substantially reduced. The latter problems have had the effect that these methods are not used by way of routine today.

Description of the Invention

The container according to the present invention is characterised in that at least one container section and the adjacent portion of the other container section are made substantially of solid material, that the two container sections can be separated, whereby the sections remain sealingly connected during the separating movement away from one another, that the container sections comprise their respective chamber for receiving their respective fluid ingredient, that the chambers are interconnected through a connecting channel defined by mutually abutting portions of each container section, that a valve seat is shaped at each end of the connecting channel for each valve member for a sealing closing of the chambers in the separated state of the container sections, that the valve members comprise mutually abutting projections ensuring a distance between the valve members exceeding the distance between the associated

valve seats in the coupled state of the container sections, but being smaller than the distance between the associated valve seats in a position during the separating movement of the container sections, and that retaining means are provided for ensuring that the valve members do not engage the valve seats in the coupled state of the container sections.

The resulting container is well-suited for use during the precipitation of fibrinogen from plasma. In addition, the container allows a sterile storing of the two separated fractions in their respective separate container section. In this manner, the fibrinogen can be stored separately in a refrigerator until it is heated to liquid state immediately before its use and transferred to a syringe so as to be used as tissue glue. The suitability of the container is partly due to the fact that one container section is made of solid material, whereby the fibrinogen can be precipitated on a solid bottom, and partly due to the fact that the container sections can be separated and are automatically closed during the separating movement, whereby the plasma and the fibrinogen are easily placed in their respective container section. As the distance between the valve members is smaller than the distance between the valve seats in a position during the separating movement of the container sections, the valve members close the openings into each container section before said container sections are completely separated during the last step of the separating movement. In this manner, the sealing closing of the container sections can be performed automatically without rendering it possible to handle the container in an incorrect manner.

According to the invention the projections of the valve members may comprise co-operating and releasable snapping means ensuring that the valve members remain coupled together in the coupled state of the container

sections. In this manner, a predetermined resistance is ensured against a separation of the valve members during the separating movement of the container sections in such a manner that the valve members are caused to engage their respective valve seats under a predetermined load, whereby said valve members can enter the engagement by way of friction and be retained in said engagement with the valve seats by the friction. In addition, one valve member can be supported at a distance from the associated valve seat by means of the other valve member and retaining means associated therewith.

The retaining means may according to the invention advantageously comprise a retaining projection placed at least on one valve member, said retaining projection extending away from the other valve member and engaging by way of friction adjacent portions of the corresponding container section.

The valve members may according to the invention be associated with their respective biased spring adapted to press said valve members into a sealing engagement with the valve seats during the separation of the container sections. In this manner, an additional pressing force is ensured for the valve members against the valve seats during and after the separating procedure.

According to the invention the retaining projection on at least one valve member may advantageously comprise a recess for a co-operation by way of friction with a projection on the wall of the corresponding container section opposite the valve seat.

Moreover according to the invention the container sections may be coupled together by means of co-operating threads, whereby the coupling and separation of the container sections can be performed in a particularly simple manner.

Furthermore according to the invention, means may preferably be provided for feeding fluid into the container under sterile conditions and for removing fluid ingredients also under sterile conditions from at least one of the separated container sections through the wall thereof. As a result it is possible to remove especially the fibrinogen from the container section in question without opening the valve.

Finally according to the invention the opposing projections of the valve members may comprise a recess on one projection, said recess telescopically receiving the other projection, and the snapping means may be formed by a circumferential rib placed on one projection and engaging a circumferential groove on the other projection with the result that the valve members are retained relative to one another in a particularly simple manner.

Brief Description of the Drawings

The invention is described in greater detail below with reference to the accompanying drawing, in which

Fig. 1 is a side and substantially sectional view of a container according to the invention,

Fig. 2 illustrates on a larger scale the lower portion of the container of Fig. 1,

Fig. 3 corresponds to Fig. 2, but in a position during the separating movement of the two sections of the container,

Fig. 4 corresponds to Fig. 2, but illustrating the two completely separated container sections, and

Fig. 5 is a diagrammatic, sectional view of another embodiment of a container according to the invention.

Best Mode for Carrying Out the Invention

The container of Figs. 1 to 4 comprises two container sections designated the general reference numerals 1 and 2. The upper container section 1 comprises a conventional bottomless blood bag 3, cf. Fig. 1, welded at the lower open end 4 between a rotationally symmetrical mouth portion 5 abutting the inner side of the blood bag 3 and a sleeve-shaped tube portion 6 abutting the outer side of said blood bag. The mouth portion 5 continues through a shoulder portion 7 into a tubular portion 8 provided with a thread 9 on the outside.

The lower seond container section 2 is screwed on the thread 9 of the mouth portion 5, cf. the drawing. The entire lower container section 2 is rotationally symmetrically shaped and comprises a tubular portion 10 provided with an internal thread 11. The internal thread 11 engages the thread 9 on the upper container section. The tubular portion 10 continues through a shoulder portion 12 into a cylindrical portion 13. The free end of the cylindrical portion is closed by means of a bottom member 14. The bottom member 14 comprises a disk with a circumferential flange 15' abutting the inner side of the cylindrical portion 13. The bottom member comprises furthermore a central, rotationally symmetrical projection 15 projecting into the interior of the second container section 2. A first valve member 16 is retained on the latter projection by way of friction, said valve member also being rotationally symmetrically shaped.

The first valve member 16 comprises a tubular portion 17 engaging the projection 15 on the bottom member 14. The cylindrical portion continues into a conical portion 18 in turn continuing into a comparatively narrower cylindrical portion 19. The cylindrical porti n 19 forms a projection of the valve member 16. The projection 19 is narrower than the cylindrical portion 17 engaging the

projection 15 of the bottom member 14. Along the transition area between the broad cylindrical portion 17 and the conical portion 18, the first valve member 16 is adapted to co-operate sealingly with the adjacent inner side of the threaded tubular portion 10 on the lower container section 2. Thus the area in question of the inner side of the tubular portion 10 forms a valve seat 21 for the first valve member. The valve seat 21 and the valve member 16 are besides formed in such a manner that they co-operate with one another by way of friction.

A second valve member 22 is telescopically received on the narrow projection 19 of the first valve member 16. Thus the second valve member 22 comprises a cylindrical projection 23 surrounding the projection 19 on the first valve member 16. Internally, the cylindrical projection 23 comprises a transverse wall 24. Like the first valve member 16, the second valve member 22 comprises a conical portion 25 expanding in a direction away from the projection 23 at the end farthest from the valve member 16 and ending at a cylindrical portion 26. The transition area between the conical portion 25 and the cylindrical portion 26 is adapted to co-operate in a sealing manner with the inner side of the mouth portion 5 of the upper container section 1 on the inner side of the threaded tubular portion 8 of said mouth portion. The portion in question of the mouth portion forms thus a valve seat 27 for the second valve member 22. The valve seat 27 and the valve member 22 are adapted to co-operate with one another by way of friction.

The end of the second valve member 22 facing the interior of the blood bag 3 is closed by means of a conical cap 28 glued thereon.

As illustrated in the drawing, the telescopically co-operating projections 19 and 23, respectively, of the two valve members 16 and 22 are of such a length that

the two valve members 16 and 22 in the position shown in Figs. 1 and 2 are retained inside their respective container section 2 and 1 at a distance from the associated valve seats 21 and 27, said valve members in Figs. 1 and 2 being supported by the projection 15 on the lower container section 2. As a result, an open connection exists between the interiors of the two container sections 1 and 2. Thus an open connection exists between a first chamber 29 inside the upper container section 1 and a chamber 30 inside the lower container section 2 through a connecting channel 31. The connecting channel 31 is defined by the tubular portions 8 and 10, respectively, of the two container sections 1 and 2. As clearly illustrated in Fig. 4, the projection 19 on the first valve member 16 comprises a circumferential rib 32. Correspondingly, the projection 23 on the second valve member 22 comprises on the inner side a circumferential groove 33. The rib 32 and the groove 33 are adapted to snap-engage one another in such a manner that the second valve member 22 remains positioned on the first valve member 16 in the position of Fig. 1 and is only released by a predetermined force in the axial direction thereof.

The distance between the two valve members 16 and 22 in the engaging position of the rib 32 and the groove 33 is of such a size, cf. Fig. 3, that the valve members 16 and 22 engage their associated valve seats 21 and 27, respectively, when the two container sections 1 and 2 have been partially unscrewed one another, but are still engaging one another through their threads 9 and 11. As also illustrated in Fig. 3, the first valve member 16 is partially disengaging the projection 15 on the bottom portion 14 of the lower container section 2 in the position in which the valve members 16 and 22 have fully engaged their valve seats 21 and 27. The engagement of the valve members 16 and 22 by means of the rib 32 and the groove 33 has the effect that the valve members 16 and 22 remain coupled together until they have been

pulled into position relative to their valve seats 21 and 27.

A continued unscrewing of the two container sections 1 and 2 relative to one another has the result that the two valve members 16 and 22 are pulled out of their engagement, cf. Fig. 4, and left sealingly engaging their respective valve seats 21 and 27.

As illustrated in the drawing, the first container section comprises a tubing 34 for the feeding of plasma to the first container section 1. The container section comprises furthermore a tubing 35 allowing feeding under sterile conditions through a conventional filter of an agent, such as alcohol, for instance ethanol, for an acceleration of the precipitation of a concentrate of coagulation factors in the container.

A rubber membrane 37 is furthermore provided within the shoulder portion 12 on the second container section, said rubber membrane allowing exsuction of concentrate from the second container section 2 by means of a syringe.

Beyond assisting in fastening the blood bag 3 on the mouth portion 5 of the upper container section 1, the outer sleeve-shaped tube portion 6 serves also to provide the container with a pleasant appearance, said tube portion 6 abutting the broad cylindrical portion 13 on the second container section 2 when the two container sections are screwed tightly together.

When the container according to the invention is used, plasma is filled therein through the tubing 14. After addition of suitable agents for accelerating the precipitation coagulation factors, the precipitation process is initiated in a conventionally known manner, such as by way of cryoprecipitation. Subsequently, the container

is subjected to a centrifuging in such a manner that the very viscous concentrate is placed in the second chamber 30 of the container inside the second container section 2. When the concentrate has been collected in the second container section 2, the container is turned in such a manner that the container section 1 with the blood bag 3 faces downwards. As a result, the blood plasma flows into the blood bag 3 while the concentrate of fibrinogen or coagulation factors remain in the container section 2 now being the upper section. Then the two container sections 1 and 2 are separated by being unscrewed one another. As the two container sections gradually reach the position shown in Fig. 3 during their separating movement, the two valve members 16 and 22 are pulled into a tight engagement with their respective valve seats 21 and 27. A continued unscrewing during the last step of the mutual separating movement of the two container sections causes the two valve members 16 and 22 to be pulled out of their engagement. Finally, the two container sections 1 and 2 reach the completely separated state shown in Fig. 4, said state allowing the sections to be handled separately according to desire. The container section 2 containing the concentrate can be placed in an refrigerator until the concentrate is to be used. When the concentrate is to be used, it is heated until it is sufficiently liquid for being sucked out through the rubber membrane 37.

Fig. 5 is a diagrammatic view of a second embodiment of the invention, where parts corresponding to the embodiment of Figs. 1 to 4 have been provided with the same reference numerals. The container of Fig. 5 comprises also two container sections 1 and 2. These container sections 1 and 2 are screwed together by means of a short thread. Therefore, a sterile-closing membrane 40 is provided about the connection place, said membrane being diagrammatically indicated. The membrane 40 is broken when the two container sections 1 and 2 are

pulled a short distance apart after having been unscrewed one another. Each container section 1 and 2 comprises a valve member 19 and 22 co-operating with their respective valve seat 21 and 27. Both valve members 19 and 22 comprise projections 41 and 42 facing away from their valve seats, said projections being received in their respective guide tubing 43 and 44, respectively. A spring 45 and 46 is arranged about each projection 41 and 42, said springs biasing the valve members 19 and 22 forwards towards their valve seats 21 and 27. The valve members 19 and 22 comprise furthermore projections 47 and 48 projecting forwards towards one another and abutting one another in the position shown in Fig. 5 so as to keep the valve members 19 and 22 in contact with the ends of the guide tubings 43 and 44 at a distance from the valve seats 21 and 27. The separation of the two container sections 1 and 2 activates the springs 45 and 46 to press the valve members against their respective valve seats 21 and 27, the two abutting projections 47 and 48 being of such a length that the valve seats engage one another before the membrane 40 is broken.

The embodiment of the container shown in Fig. 5 is used in the same manner as stated above.

The container according to the invention is easily produced from injection moulded parts, and as far as the embodiment of Figs. 1 to 4 is concerned the two valve members 16 and 22 are assembled before the blood bag 3 is glued onto the mouth portion 5. Before the second valve member 22 is secured to the first valve member 16, said first valve member is mounted on the projection 15 on the bottom member 14, which is subsequently glued onto the second container section 2. The blood bag 3 is, as mentioned, fastened by way of gluing, but it can also be fastened by way of welding. Both the second container section 2 and the valve members 16 and 22 as well as the mouth portion 5 of the first container section 1 and the

sleeve-shaped tube portion 6 are made of a solid plastic material, which may be of any suitable nature, such as polyvinyl chloride.

The invention has been described with reference to preferred embodiments. Many modifications may, however, be carried out without thereby deviating from the scope of the invention. The container of Figs. 1 to 4 may for instance be of another shape than the rotationally symmetrical shape. Suitable sealing means may furthermore be provided in order to ensure the necessary sealing. The described container is preferably intended for use in connection with blood plasma, but it may, of course, also be used for other fluids with ingredients available in states allowing the described separation.

Claims.

1. A container for receiving and separating a fluid, preferably blood plasma, into its ingredients, where said container comprises two sealingly coupled sections, c h a r a c t e r i s e d in that at least one container section (2) and the adjacent portion (5, 6) of the other container section (1) are made substantially of solid material, that the two container sections (1, 2) can be separated, whereby the sections (1, 2) remain sealingly connected during the separating movement away from one another, that the container sections (1, 2) comprise their respective chamber (29 and 30) for receiving their respective fluid ingredient, that the chambers (29, 30) are interconnected through a connecting channel (31) defined by mutually abutting portions (8, 10) of each container section (1, 2), that a valve seat (21, 27) is shaped at each end of the connecting channel (31) for each valve member (22, 16) for a sealing closing of the chambers (29, 30) in the separated state of the container sections (1, 2), that the valve members (22, 16) comprise mutually abutting projections (23, 48; 19, 47) ensuring a distance between the valve members (22, 16) exceeding the distance between the associated valve seats (27, 21) in the coupled state of the container sections (1, 2), but being smaller than the distance between the associated valve seats (27, 21) in a position during the separating movement of the container sections (1, 2), and that retaining means (15, 17; 41, 43, 44, and 46) are provided for ensuring that the valve members (22, 19) do not engage the valve seats (27, 21) in the coupled state of the container sections (1, 2).

2. A container as claimed in claim 1, c h a r a c t e r i s e d in that the projections (19, 23) of the valve members (16, 22) comprise co-operating and releasable snapping means (32, 33) ensuring that the valve

members (16, 22) remain coupled together in the coupled state of the container sections (2, 1).

3. A container as claimed in claim 1 or 2, c h a r a c t e r i s e d in that the retaining means (15, 17) comprise a retaining projection (17) placed at least on one valve member (16), said retaining projection extending away from the other valve member (22) and engaging by way of friction adjacent portions of the corresponding container section (2).

4. A container as claimed in claim 1 or 2, c h a r a c t e r i s e d in that the valve members (16, 22) are associated with their respective biased spring (45, 46) adapted to press said valve members (16, 22) into a sealing engagement with the valve seats (21, 27) during the separation of the container sections (2, 1).

5. A container as claimed in claim 3, c h a r a c t e r i s e d in that the retaining projection (17) on at least one valve member (16) comprises a recess for a co-operation by way of friction with a projection (15) on the wall (14) of the corresponding container section (2) opposite the valve seat (21).

6. A container as claimed in one or more of the preceding claims 1 to 5, c h a r a c t e r i s e d in that the container sections (1, 2) are coupled together by means of co-operating threads (9, 11).

7. A container as claimed in one or more of the preceding claims 1 to 6, c h a r a c t e r i s e d in that means (36, 37) are provided for feeding fluid into the container under sterile conditions and for removing fluid ingredients also under sterile conditions from at least one of the separated container sections (1, 2) through the wall thereof.

8. A container as claimed in one or more of the preceding claims 2 to 5, c h a r a c t e r i s e d in that the opposing projections (19, 23) of the valve members (16, 22) comprise a recess on one projection (23), said recess telescopically receiving the other projection (19), and that the snapping means (32, 33) are formed by a circumferential rib (32) placed on one projection and engaging a circumferential groove (33) on the other projection.

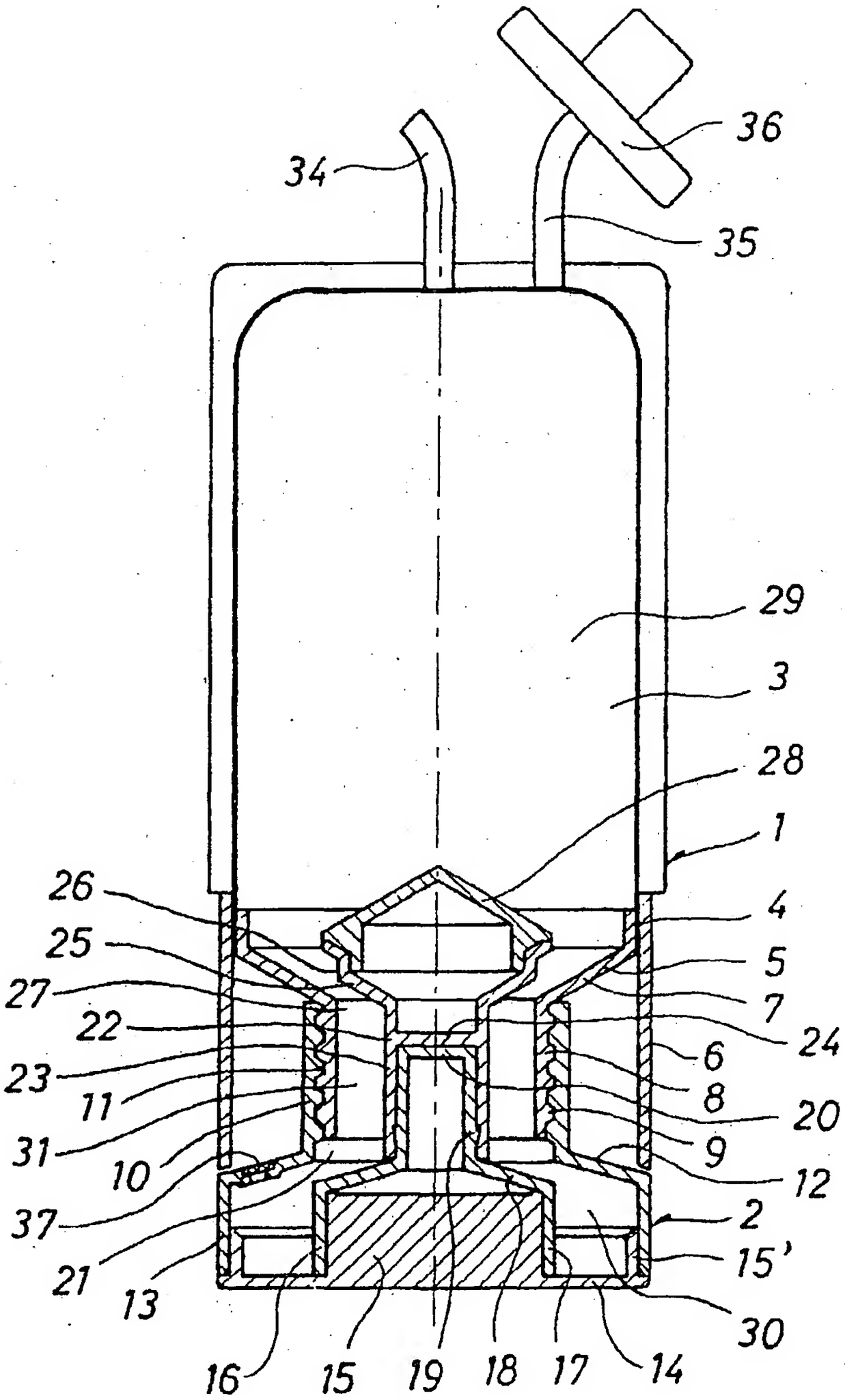
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Fig.1

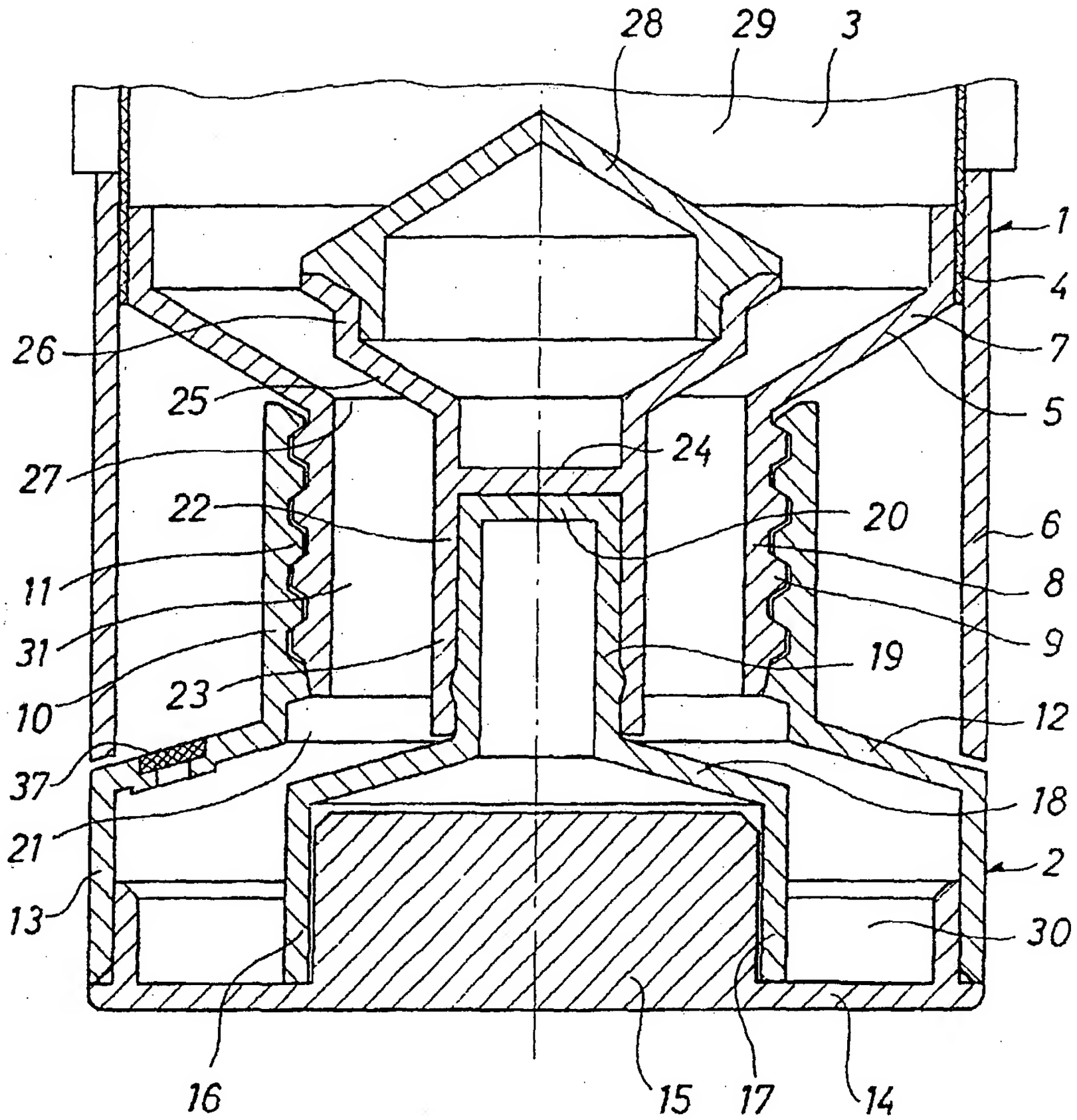
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Fig.2

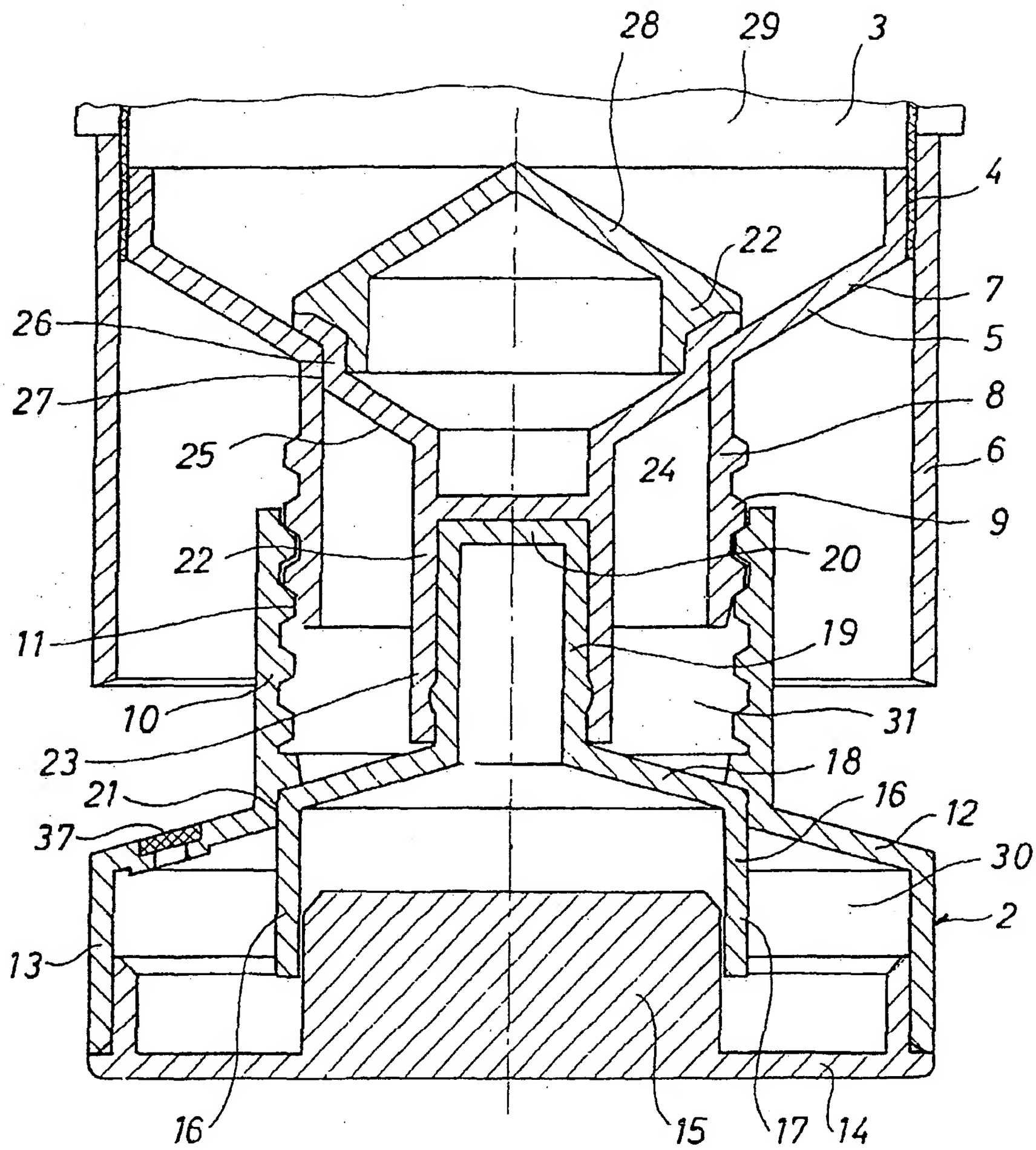
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Fig.3

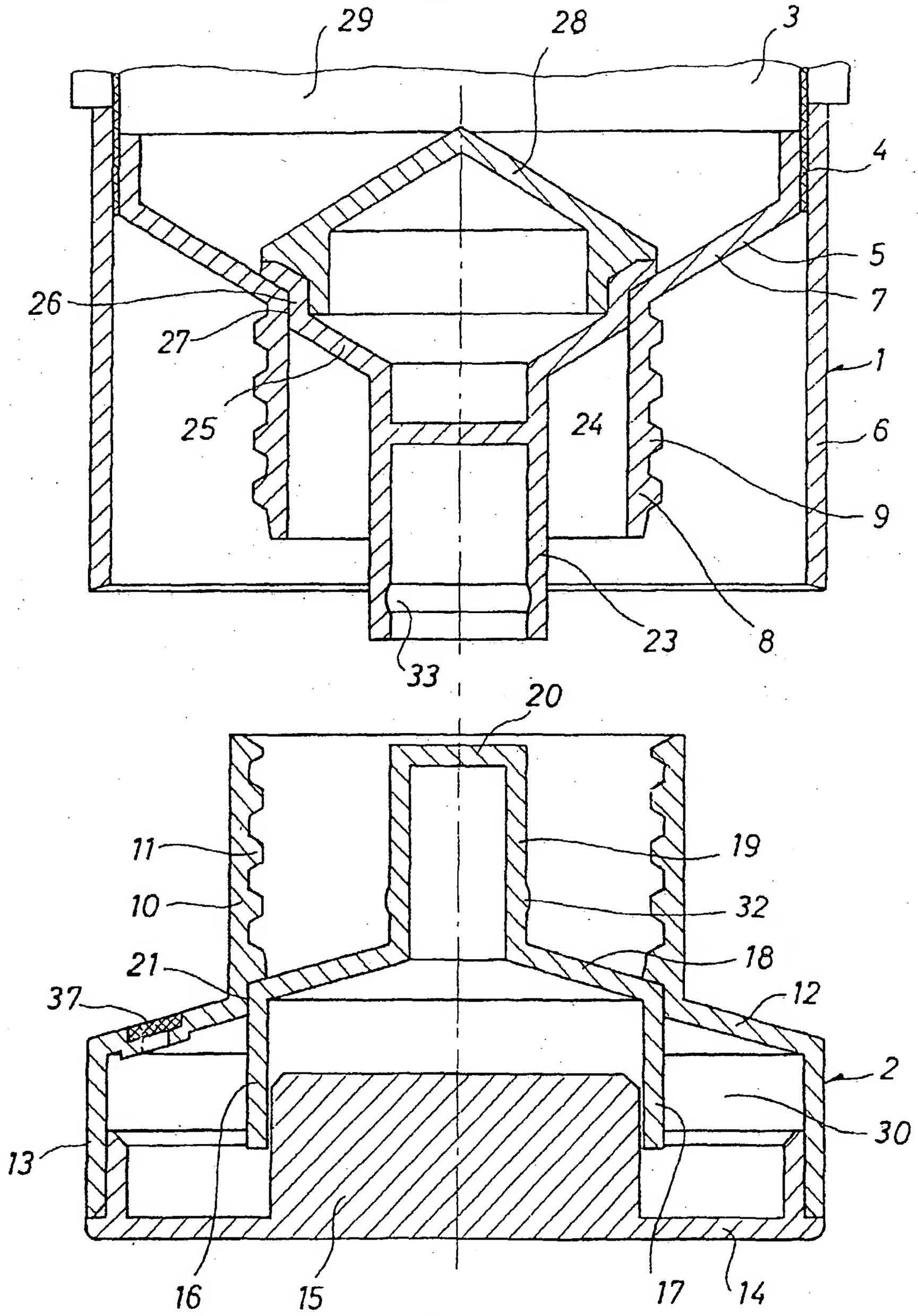
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Fig.4

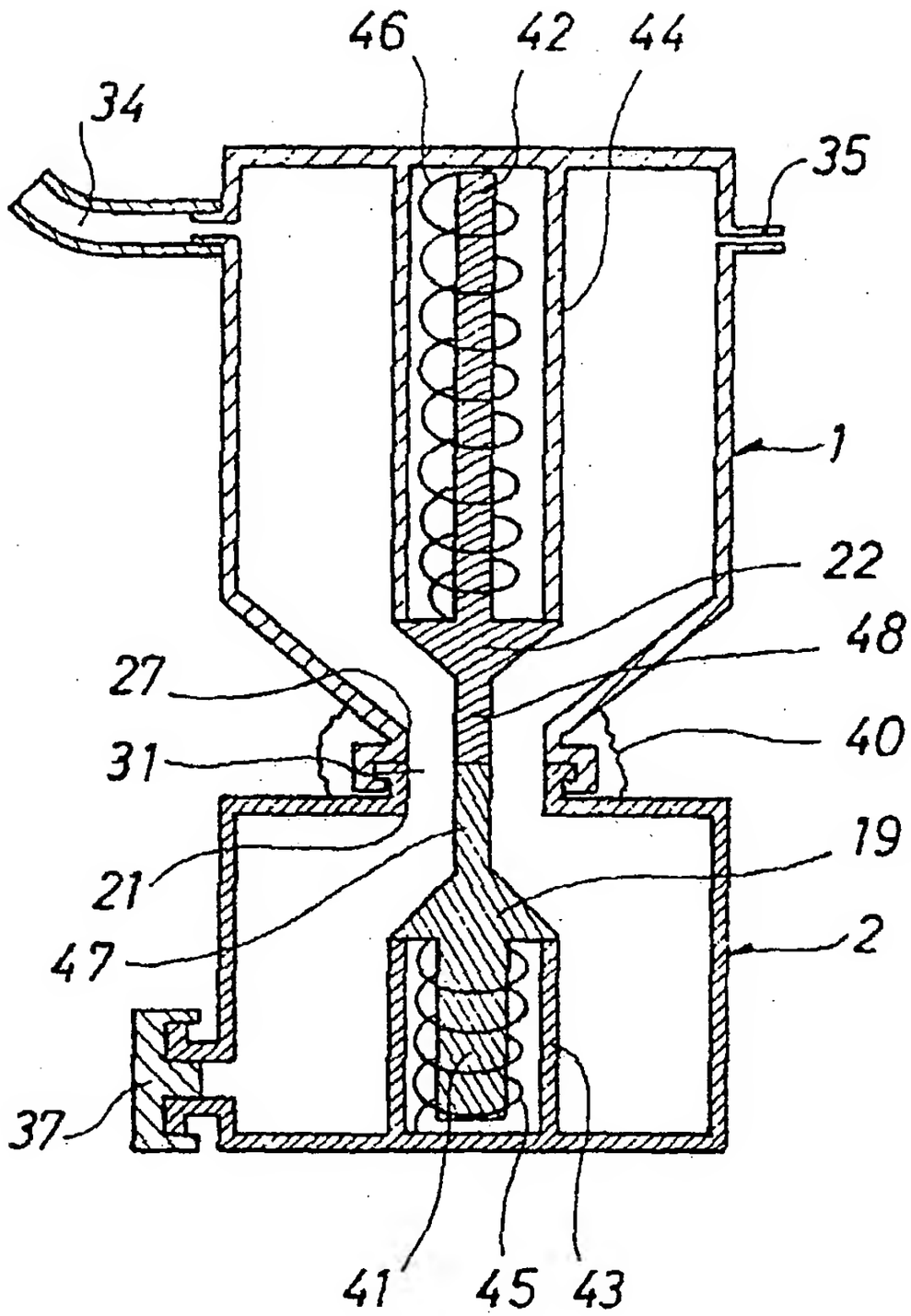

Fig.5

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 92/00329

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 61 J 1/05

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 61 J

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	EP, A2, 0446713 (MILES INC.) 18 September 1991, see the whole document --	1-8
A	EP, A1, 0505962 (MIRAMED S.P.A.) 30 September 1992, see the whole document --	1-8
A	US, A, 4714457 (ALTERBAUM) 22 December 1987, see the whole document --	1-8

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* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
10th February 1993	16 -02- 1993
International Searching Authority	*Signature of Authorized Officer*
SWEDISH PATENT OFFICE	Agneta Änggård

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/DK 92/00329

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A2- 0446713	91-09-18	US-A- 5102407	92-04-07
EP-A1- 0505962	92-09-30	NONE	
US-A- 4714457	87-12-22	NONE	

Details of an anaesthetic vaporiser, and of filling systems which comprise an anaesthetic vaporiser and a supply container for an anaesthetic agent, are disclosed in the specification of an International patent application entitled Fluid Delivery Systems, filed with the present application and claiming priority from UK patent application number 9101560.2. All subject matter disclosed in that document is incorporated in the specification of the present application by this reference to the document.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic cross-section a part of a container for an anaesthetic agent, showing the outlet from that container;

Figure 2 is a schematic cross-section through the container shown in Figure 1 connected to the inlet of a sump;

Figure 3 is a schematic cross-section through another embodiment of outlet from a container for an anaesthetic agent;

Figure 4 is an isometric view of an embodiment of conduit through which liquid can be supplied from the outlet from the reservoir of the container to a sump; and

Figure 5 shows views of a bottle for an anaesthetic agent, and an anaesthetic vaporiser to which the bottle can be connected.

Referring to the drawings, Figure 1 shows a container 2 for an anaesthetic agent, in the form of a bottle which provides a reservoir within it for anaesthetic agent. The container is

formed from glass, which is provided with a coating of plastic film, which has the advantage that pieces of the material of the bottle which arise from fracture, for example under pressure from the anaesthetic vapour when the bottle is exposed to elevated temperature, are retained loosely connected to one another. The outlet 4 from the reservoir is closed by means of a valve assembly 6, which is attached to the outlet from the reservoir in the container by means of a crimped ferrule. The outlet includes a conduit 10, through which fluid is supplied from the reservoir in the container 2. The aperture 12 into the conduit 10 at the end proximal to the reservoir is closed by means of a moveable valve member 14. The valve member can move between a closed position in which it closes the aperture 12 and an open position as shown in Figure 1. A spring 16 acts to force the valve member 14 towards the closed position. A cage 18 restricts movement of the valve member 14 in the open position.

A screw cap may be provided to close the bottle, to provide a seal against egress of anaesthetic agent, liquid or vapour, during transportation of the bottle. The cap may be provided with a deformable seal within it, by which a seal can be made to the bottle.

At the end remote from the container 2, the conduit 10 has an O-ring 20 provided in a groove.

The conduit 10 has formed on its outer surface, towards the end proximal to the reservoir, a circumferentially extending flange 22, which presents a surface facing in a direction substantially opposite to the direction in which fluid passes out of the reservoir through the outlet.

Attached to the valve member 14 is a cylindrical partition 25 which extends through the conduit 10, coaxially with it. The partition defines two coaxial chambers 26, 27 within the conduit. The outer chamber 26 is for flow of fluid, generally

liquid, from the reservoir in the container 2 into the sump of a vaporiser, and the inner chamber 27 is for flow of fluid, which may be liquid or vapour, in the return direction. A deflector 28 can be provided towards the end of the partition adjacent to the valve member, to divide the flows of fluid in the two chambers, and ports 29 are provided through which fluid can pass out of the inner chamber 27.

Figure 2 shows the container 2 and valve assembly 6 depicted in Figure 1 mounted on the inlet 30 of a sump contained within an anaesthetic vaporiser 32. The inlet 30 has a valve 34 provided within it, which includes a valve member 42 which, when closed, abuts the lower end (as shown) of the inlet conduit 10. In this position, the valve is closed and prevents flow of fluid between the inlet conduit and the sump. As shown in Figure 2, the valve member is displaced from the end of the conduit 10, against the force exerted by the fluid within the sump and force exerted by a spring 44. The inlet 30 also includes a cylindrical receptacle 38 for the conduit 10 on the container valve assembly, and a cylindrical partition 39 which extends through the receptacle, coaxially with it. The partition defines two coaxial chambers within the receptacle, which communicate with the chambers 26, 27 defined by the partition 25 within the nozzle 10. The inner chamber terminates at ports 41 through which fluid can enter and leave that chamber.

Two passageways 43, 45 communicating with respective ones of the ports 41 from the coaxial chambers within the receptacle, allow flow of fluid between the sump within the vaporiser. The first passageway 43 provides for flow of fluid, generally liquid, from the supply container into the sump, and the second passageway 45 provides for flow of fluid in the return direction.

Figure 3 shows a container 2 for an anaesthetic agent, with an outlet 4 which is closed by means of a valve assembly 6. The valve assembly includes a conduit 10 which is closed by means

of a moveable valve member 14. The conduit contains a cylindrical partition 25 which divides the conduit into two coaxial passageways. Access of fluid to the inner passageway is gained via ports 49.

The valve member 14 can move between a closed position in which flanges 51, 53 close openings 55, 57 into the passageways in the conduit 10, and an open position as shown in Figure 3. A spring 16 acts to force the valve member 14 towards the closed position, and a cage 18 restricts movement of the valve member 14 in the open position.

Figure 4a shows schematically a container 150 for an anaesthetic agent and sump within an anaesthetic vaporiser 152, with a conduit 154 connecting them. The conduit is divided into two or more chambers, at least one of the chambers being located above at least one other of the chambers. The conduit extends from the vaporiser towards the supply container at an angle of about 45° to the vertical. The lower chamber 156 of the conduit contains liquid passing from the supply container 150 to the vaporiser 152. The upper conduit 158 provides a path for flow of vapour from the sump to the supply container. This makes it possible for vapour pressure between the two containers 150, 152 to be equalised, and facilitates flow of liquid from the supply container to the sump.

Figures 4b and 4c show a preferred conduit in different orientations. Each conduit has a circular cross section, and contains an insert made up of two partitions arranged substantially perpendicularly to one another. The two partitions divide the container into four chambers. Whatever the orientation of the conduit, at least one of the chambers will be located above at least one of the other chambers within the conduit, thus providing respective pathways for flow of liquid and flow of vapour.

Figures 5a to 5c show views of a container 202 for an

anaesthetic agent under pressure, which is mounted on an inlet 204 to a sump in an anaesthetic vaporiser 205, for supply of the agent from a reservoir in the container into the sump.

The reservoir in the container 202 includes a valve assembly 206 which is clamped onto the mouth of the reservoir by means of a ferrule 208, generally as described with reference to Figure 1 above. The valve assembly includes a valve member which, when the reservoir is not connected to the sump, prevents escape of the agent from the reservoir. It also includes a conduit 210 by which flow of the agent from the reservoir is directed. An O-ring 212 and an outwardly extending flange 213 are provided on the outer surface of the conduit towards its free end.

The vaporiser 205 includes an inlet 204 for the free end of the conduit 210 on the reservoir. A valve, with an insert for opening that valve and the valve on the reservoir, may be provided for example similar to those components of the vaporiser described with reference to Figure 2. The inlet includes a receptacle 216 which contains a sealing surface on its internal surface against which the O-ring 212 acts to form a seal between the reservoir in the container and the vaporiser. The inlet is mounted for rotation about an axis B-B' on the housing 218 of the vaporiser (in which the pump is located), and contains a conduit through which anaesthetic agent entering the vaporiser from a container through the inlet passes into the sump. The conduit has at the end proximal to the housing an opening in its side wall which, together with an opening into the sump, provide a valve by which flow of fluid into the sump can be controlled. As a result, rotation of the inlet about the axis B-B' will cause the valve provided by the openings in the conduit and the sump to open.

The housing 218 has a guide 220 mounted on it for the rotation of the inlet 204. The guide has a key-hole shaped slot 222 provided in it, including a widened portion 224 at one end.

The widened portion is able to receive the receptacle 216 in it, the receptacle being urged outwardly from the body of the inlet into the widened portion of the slot by means of a spring 226. The inlet is prevented from rotating relative to the housing of the vaporiser while the receptacle is so engaged in the widened portion of the slot as a result of the side walls of the slot engaging the sides of the receptacle.

The receptacle 216 can be caused to move against the force exerted by the spring 226 by insertion of the free end of the conduit 210, so as to free the receptacle for movement along the slot 222 as the inlet is rotated relative to the vaporiser housing. As the inlet 204 and the reservoir in the container 202, whose conduit has been inserted into the inlet, are rotated relative to the slot, the side walls of the slot 222 engage the flange provided on the free end of the conduit, and retain the container engaged with the receptacle. This prevents the container from being forced away from the receptacle when connection between them is exposed to elevated pressure within the reservoir in the container and the sump.

The axis B-B' about which the inlet rotates relative to the housing is preferably horizontal. It is particularly preferred that the axis is arranged so that the inlet is moved upwardly to open the valve into the sump. Preferably, a reservoir engaging the inlet requires to be held in the raised (valve open) position for the valve to remain open, so that the valve is only open while an operator is present. If necessary, the receptacle may be biassed towards the downward facing position, for example by means of a spring which acts between the inlet and the housing.

CLAIMS:

1. A container for a liquid anaesthetic agent for supplying the agent to an anaesthetic vaporiser, the container comprising:

(a) a reservoir for the liquid agent;

(b) a valve which, when closed, prevents the flow of the liquid agent from the reservoir;

(c) a tubular outlet through which the liquid can leave the reservoir when the valve is open; and

(d) a sealing surface provided towards the free end of the outlet extending around the perimeter thereof, for forming a seal with a corresponding sealing surface provided at an inlet to a vaporiser to which the anaesthetic agent is to be supplied.

2. A container as claimed in claim 1, which includes means for forming a connection between the container and a vaporiser to retain the container on the vaporiser.

3. A container as claimed in claim 2, in which the connecting means comprises a formation which presents a surface facing in a direction substantially opposite to the direction in which fluid passes out of the reservoir through the outlet.

4. A container as claimed in claim 3, in which the formation comprises a flange which extends at least partially around the perimeter of the container.

5. A container as claimed in any one of claims 1 to 4, in which the outlet includes a conduit which extends from the reservoir.